REMARKS/ARGUMENTS

Applicants' representative would like to thank Examiner Bissett for the courteous and helpful discussion of the issues in the present application on June 9, 2004. The following remarks and accompanying Rule 1.132 Declaration summarize and expand on the content of that discussion.

Claims 1-10, 27, 28 and 52-54 are under consideration in the present application, claims 11-26 and 29-51 having been withdrawn from consideration.

The present invention relates to a surface having ultraphobic properties, which comprises a hydrophobic or oleophobic material, or is coated by a hydrophobic or oleophobic material, and has a surface topography in which the value of the integral of a function S

$$S(\log f) = a(f) \cdot f$$

Which gives a relationship between the spatial frequencies f of the individual Fourier components and their amplitudes a(f), and wherein the value of the integral is at least 0.5 between the integration limits $\log(f_1/\mu m^{-1}) = -3$ and $\log (f_2/\mu m^{-1}) = 3$.

Applicants have found that by providing such surfaces having the required value of at least 0.5 for the integral of function S within the stated limits, an ultraphobic surface is obtained.

The claims stand rejected, in various combinations, under 35 U.S.C. 102(b) over Clark et al or Takahashi et al, or under 35 U.S.C. 103(a)Clark et al in view of Baumann et al, or Takahashi et al in view of Goetz et al. None of the applied references describe an ultraphobic surface having the claimed surface topology.

All of the above rejections rely on either Clark or Takahashi as inherently describing a structured surface having the claimed surface topography.

However, as previously noted, Applicants' prior Rule 1.132 Declaration shows that surfaces described in the prior art, which have contact angles in excess of 150° and provide

roll off of water droplets at the "slightest inclination of the substrate" (i.e., Clark at column 6, lines 52-53) do not *necessarily* possess the claimed surface topography. In other words, the Declaration shows that although a surface may have ultraphobic properties, it does not necessarily or inherently have the claimed surface topography (i.e., Examples 1, 7, 8, and 10 of Clark). Accordingly, since it has been shown that ultraphobic surface properties do not depend on the claimed surface topography, the Examiner can no longer assert that the claimed surface topography is *inherent* to ultraphobic surfaces. Thus, Applicants' Declaration is sufficient to show that neither Clark nor Takahashi inherently describe the claimed surface topography. Accordingly, since Clark and Takahashi neither expressly nor inherently describe the claimed surface topography, Clark and Takahashi fail to anticipate the claimed surface.

Moreover, because neither Clark nor Takahashi expressly or inherently describe a surface having the claimed topography, as discussed above, the Examiner has failed to support a *prima facie* case of obviousness, since none of the applied references in combination with Clark or Takahashi "teach or suggest all the claim limitations" (M.P.E.P. § 21143). Accordingly, none of the applied references, either individually or in combination suggest the claimed invention.

During the discussion with the Examiner, the Examiner requested clarification of several points regarding the prior Declaration. Applicants provide herewith a further Rule 1.132 Declaration addressing those points. As noted in the Declaration:

The data of Examples 1, 7, 8 and 10 of the Clark reference (U.S. Patent 5,674,592) were used to calculate the topography of surfaces consisting of nanostructure elements according to Clark as embodied in the S integral value as used in the present invention. In particular, the data used were the height of the nanostructure elements, the tip diameter of the nanostructure elements and the areal number densities of the nanostructure elements. These

were the same data used in calculating the value of the S integral in the examples of the present application. The calculations were performed with 262,144 points per calculation. This number of points per calculation is more than adequate to model the topography accurately.

The resulting height profiles were processed in exactly the same manner as described in the present application at page 14, lines 23-27; page 25, lines 1-22 and page 29, lines 6-19, and as described in my previous Declaration. No manipulation of the data was required or performed in order to calculate the S integral value. The calculations were performed in exactly the same manner as the examples in the present application using exactly the same type of data.

For the Examiner's information, the number m=n=512 points in both x and y directions was used, since it matches the number of points in the x and y directions of the height profiles in the examples of the present application (see, for example, page 28, line 1 to page 29, line 4). Accordingly this choice of the number of points in each of the x and y directions was chosen to make the results calculated in the examples of the present application and those calculated based upon the data in Clark be directly comparable.

With respect to the hydrophobic substance modeled in the calculations reported in the previous Declaration: In the Clark patent, the hydrophobic substance $C_8H_{17}(CH_2)_{11}SH$ on smooth gold consists of a contact angle of $\Theta_a = 125°$ (advancing contact angle Θ_a) and $\Theta_r = 105°$ (receding contact angle Θ_r) (see Table 2, example 3 of Clark) Since the contact angle hysteresis $\Delta\Theta = \Theta_a - \Theta_r = 20°$ is small, one can approximate the apparent contact angle Θ (or equilibrium contact angle) according to the well known equation $\Delta\Theta \sin\Theta \approx \cos\Theta_r - \cos\Theta_a$ (see e.g. J. Kijlstra et al, Colloids and Surfaces 206, 521 (2002)) yielding $\Theta = 116°$. The model used in the Declaration thus implies an apparent contact angle of a smooth gold coated surface of $\Theta = 115°$ as seen from example 6 in the specification. Thus the model used in the

Declaration corresponds to a hydrophobic coating equivalent to the compound used in the Clark patent.

Accordingly, as shown in Table 1 of the earlier Declaration (a copy of which is attached to the present Declaration), no additional information was needed beyond the information provided by Clark and the model used in the present invention to carry out the calculations and verify that even though Clark shows a contact angle larger than 170°, the surfaces provided by Clark do **not** provide a surface structure resulting in an integral S (log f) of at least 0.5, as required in the present invention. The integrals achieved with the surfaces according to Clark ranged from 0.017 to 0.134 and are thus three times smaller than the value of the integrals claimed. Accordingly, the structure of the surfaces generated according to Clark are significantly different from the structure of the surfaces of the present invention, even though the structures of Clark have comparable water contact angles.

Applicants therefore respectfully submit that the Declarations are sufficient to show that surfaces having ultraphobic properties do not inherently possess the claim surface topography, and to address the Examiner's concerns.

With regard to Takahashi, the Examiner assumes that because the surfaces of Takahashi possess ultraphobic properties, these surfaces must inherently possess the claimed surface topography. However, Applicants' Declaration shows that surfaces which have ultraphobic properties do not inherently possess the claimed surface topography. Thus, the Examiner's assumption that the claimed surface topography is inherent to the surfaces of Takahashi is incorrect. Thus, Applicants respectfully submit that no further evidence must be provided in order to overcome Takahashi.

In addition, Table 1 at page 40 of the specification shows that that the claimed range of values of the integral of function S provides significantly improved contact angles

compared to otherwise similar surfaces having values of the integral function S outside the claimed range. Thus, the claimed range of values of the integral of function S is result-effective in regard to the properties (i.e., contact angle) of the surface. None of the applied references recognize the importance of a surface topology in which the value of the integral of function S falls within the claimed range. Thus, as a matter of law, it would not be obvious to modify the surfaces of Clark or Takahashi to provide the claimed surface. M.P.E.P. 2144.05(II)(B). Accordingly, the applied references, either individually or in combination, fail to suggest the claimed invention.

Accordingly, since Applicants have shown that the claim surface topography is not necessarily present in the surfaces of Clark or Takahashi, none of the applied references, alone or in combination, either anticipate or suggest the claimed invention. Applicants therefore respectfully request that the rejections be withdrawn.

The rejection of the claims under 35 U.S.C. § 112, first paragraph is respectfully traversed. The Examiner has already stated that the specification is "enabling for the product made in the examples in the specification, and therefore Applicants respectfully submit that the claimed invention is sufficiently "enabled" by the specification.

The Examiner states that the specification "does not reasonably provide enablement for *any and every* surface having the claimed properties" (emphasis added). However, Applicants respectfully submit that the Examiner has applied an incorrect legal standard. M.P.E.P. § 2164.01(b) states that "as long as the specification discloses ***at least one method*** for making and use the claimed invention that bears a reasonable correlation to the entire scope of the claim, then the enablement requirement if 35 U.S.C. § 112 is satisfied" (emphasis added). Applicants have described significantly more than one method of making and using the claimed invention. The Examples of the specification describe various different methods for preparing a surface having the claimed surface topography (e.g., by

etching or deposition of fine particles), and provide examples of various oleophobic and hydrophobic materials. Furthermore, the specification provides a detailed description at pages 28-29, of methods for determining surface topography. Moreover, Applicants respectfully submit that one of ordinary skill in the art would reasonably understand, based on the ample description and examples of the present specification, how to make and use the claimed invention. While the standard requires that one of ordinary skill must be able to practice the invention without undue experimentation, this does not require that each and every embodiment must be explicitly described in the application. Further, this standard does not require that no experimentation be needed to practice the full scope of the invention. Given the disclosure in the present application of methods for making the present ultraphobic surfaces having the required surface topography, the disclosure of a variety of materials for preparing such surfaces, and the method by which to determine whether the formed surfaces have the required topography, one of ordinary skill in the art would be readily able to practice the invention without requiring undue experimentation. Accordingly, Applicants respectfully submit that the claimed invention is enabled under the standard discussed in M.P.E.P. § 2164.01(b). Applicants therefore request that the rejection be withdrawn.

Applicants submit that the application is now in condition for allowance and early notification of such action is earnestly solicited.

Respectfully submitted,

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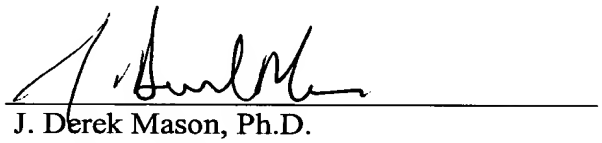

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